THREE ESSAYS ON INTERNATIONAL TRADE AND WELFARE

By

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I dedicate this dissertation to memory of the late Hiroshi Okamura, my father and Misuzu Okamura, my mother.

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I formulate a two-period, two-sector, specific factor, general equilibrium trade model with endogenous tariff formation. The tariff rate depends on labor devoted to lobbying in each of the two industries. We examine the possibility of quid pro quo direct foreign investment (DFI). It is shown that more DFI in the exporting sector reduces the level of protection and quid pro quo DFI occurs. Quid pro quo DFI takes place if DFI in the importing sector increases directly the ability of the host-country government to resist protection.

I construct a two-country Ricardian dynamic general equilibrium model with learning-by-doing and transportation cost. The two countries differ only in the distribution of the consumer's preference. At the initial time, no trade occurs due to transportation costs. There exists a unique time when trade begins. After that time, each country exports the goods for which it has a stronger preference

than does the other country. A government can completely reverse the pattern of trade by a tax-transfer policy to change the distribution of income. A tariff delays the time when trade begins, while a quota does not affect the timing of trade.

Finally, I formulate a open economy model in a two-by-two general equilibrium setting. Unskilled workers establish a labor union and bargain with a firm about their employment level and wage, while skilled workers are employed in a competitive market. Both parties are engaged in Nash bargaining. The labor union is assumed to be employment oriented. I establish that trade liberalization decreases the wage on unskilled workers in the unionized sector if the unionized sector is labor unskilled labor intensive. I also show that immigration of unskilled labor decreases the wage of unskilled unionized labor if the unionized sector is unskilled labor intensive.

CHAPTER 1
INTRODUCTION

According to traditional theories of international trade, typically, in the original Hechsher-Ohlin-Samuelson general equilibrium framework, three assumptions are imposed: First, capital movement from one country to another country is seen essentially as s substitute to a commodity trade. Direct Foreign Investment(DFI) is induced flow from the capital abundant country with low reward to the capital scare country with high reward to seek higher return. Second, technologies of trading countries are assumed to be given. That is, no technical changes occur at these countries. Third, in both product markets and factor markets, perfect competition prevail. In this dissertation, I construct three models to examine and extend these three assumptions.

Chapter 2 of the dissertation analyzes political-economic aspect of DFI. There have been two distinct approaches, which attempts to incorporate various political-economy considerations. The first strand of literature has focused on product markets by modeling resource-using lobbying or by modeling voting behavior. The level of protection is determined through the self-interest maximizing behavior of economic agents. The second strand of literature is associated with "Quid Pro Quo" Direct Foreign Investment (DFI). This strand examines how DFI can be used to defuse the threat of protection (or the actual level of protection) based on political-economy considerations DFI aims at diffusing future protection even if it is associated with current losses. I construct a

two-period, two-sector, specific factor model with DFI and endogenous lobbying to integrate these two strands. In this model, I examine in which sector, the exporting or importing sector is engaged in quid pro quo DFI to defuse future protection of host country.

Chapter 3 builds a simple dynamic Ricardian general equilibrium model with learning-by-doing effects of technologies. The learning-by-doing effect means that each firm can learn from its experience and improve its technology. Two types of consumers in each of the two countries are considered. Each type has preferences over a particular set of similar products. The distribution of the two types of consumers differs across the two countries. Current productivity of labor, which the only factor of production, increases over time because of learning-by-doing considerations. The dynamic nature of the model allows us to determine the duration of autarky based on transportation costs. Transportation costs provide a realistic and natural way to generate an initial period without trade, which is necessary to allow the interaction between national differential tastes and learning-by-doing. I investigates the effects of domestic income transfers across different types of consumers, tariffs and import quotas on the pattern and volume of trade.

Chapter 4 of the dissertation constructs a general equilibrium model of an open economy with unionized sector. The export producing sector is perfectly competitive and utilizes two factors of production, skilled and unskilled labor. The import-competing sector consists of a unionized firm that is protected from foreign competition through an import quota. The domestic monopolist utilizes both skilled and unskilled labor under a constant returns to scale technology. However, unlike the

labor demand for skilled workers which is assumed to be competitive, I assume that the unskilled workers in the import-competing sector have formed a labor union. The union bargains with the domestic monopolist over the negotiated wage and the employment of unskilled labor. The bargaining process is modeled as an efficient Nash bargaining game that results in simultaneous determination of employment and the wage. I analyze the effects of trade liberalization (i.e. an increase in the quota) and immigration on income distribution and domestic prices. I identify conditions on the parameters of the model that establish the robustness of the Stolper- Samuelson mechanism in the presence of sector-specific labor union. I also characterize conditions for the existence of a unique equilibrium.

CHAPTER 2
ENDOGENOUS TARIFF FORMATION AND DIRECT FOREIGN INVESTMENT: A GENERAL EQUILIBRIUM ANALYSIS

2.1. Introduction

There have been two distinct approaches to the theory of endogenous protection, which attempts to incorporate various political-economy considerations in the formation of tariffs, quotas and other instruments of protection. The first strand of literature has focused on product markets by modeling resource-using lobbying (i. e., Findlay and Wellisz (1982)) or by modeling voting behavior (i. e., Mayer (1984)). In both cases, the level of protection is determined through the self-interest maximizing behavior of economic agents. The second strand of literature is associated with "Quid Pro Quo" Direct Foreign Investment (DFI). This strand examines how DFI can be used to defuse the threat of protection (or the actual level of protection) based on political-economy considerations. Bhagwati (1985, 1986, 1987) has identified the new type of DFI which aims at diffusing future protection even if it is associated with current losses. Bhagwati et al. (1987), Dinopoulos (1989, 1992), Wong (1989) Dinopoulos and Wong (1991), and Zhao (1991) have developed models of Quid Pro Quo DFI.

These two distinct approaches to endogenous protection aim at understanding the instruments and channels which determine the level of protection, but have ignored each other's implications. For example, although Findlay and Wellisz (1982) have emphasized the resources which are utilized in the lobbying process within the context of general equilibrium, Bhagwati et al. (1987) do not model the resource cost of

lobbying. In addition, by focusing on product markets, the first strand the literature has abstracted from factor mobility influences on the level of protection. Moreover, since the Quid Pro Quo DFI literature examines the potential for defusing (or reducing) existing protection, it has opposite implications to the resource using lobbying literature which studies the conditions under which protection emerges. Therefore, there is some scope for integrating the two approaches in order to analyze how endogenous protection based on resource using lobbying is affected by DFI.

Quid Pro Quo DFI corresponds to a novel form of foreign lobbying which utilizes resources in the present (by incurring a welfare loss for the foreign country) in order to reduce protection in the host country in the future (with the associated benefits). Therefore, it is possible to build a model of endogenous protection with domestic lobbying which uses resources and foreign lobbying which causes DFI in a quid pro quo fashion. I construct a two-period, two-country, specific-factor general equilibrium trade model with direct foreign investment. Following Findlay and Wellisz (1982), a tariff formation function is added in the second period. Free trade prevails in the first period. The two-period, two-country framework is adopted from Bhagwati et al (1987).

By adopting the two-sector specific-factor model, I can examine in which sector, the exporting or the importing, does quid pro quo DFI take place. This paper shows that the level of DFI is substitutive (complementary) to the lobbying activity and protection when DFI occurs in the exporting (importing) sector. This reduces the level of protection, which encourages the foreign government to engage quid pro quo DFI. On the other hand, the difference between lobbying activities expands as the result of DFI in the importing sector, which leads to a higher tariff rate. However, if DFI increases the host-country government

resistance to lobbying and this effect overcomes the effect of lobbying activity, the tariff rate is reduced by DFI and there is scope for quid pro quo DFI. Another channel by which DFI influences protection is also shown: the amount of labor devoted to productive activities may increase as the result of DFI. The foreign country exports more and obtains a higher level of welfare. The foreign government chooses DFI taking this "productive labor expansion effect" into account. This effect emerges in the general equilibrium framework of the model in which the tariff is determined through resource-using lobbying activities.

Section 2.2 formulates the model. Section 2.3 characterizes the equilibrium. Section 2.4 develops basic comparative statics. Section 2.5 calculates the optimal DFI levels. Section 2.6 analyzes the possibility of quid pro quo DFI and section 2.7 offers the concluding remarks of the chapter.

2.2. The Model

I formulate a two-country, specific-factor, general-equilibrium model with endogenous tariff formation using building blocks from Findlay and Wellisz (1982). There are two countries, foreign and domestic, in the world. A manufactured good and an agricultural good are produced under perfect competition and traded in both countries.

First I describe the host country. The manufactured (agricultural) good is produced by a specific factor, capital (land), and a mobile factor, labor. I denote the manufactured (agricultural) good by X (Y). The production functions are

$$X = F(K, L_x), \tag{1}$$

$$Y = G(T, L_y), \tag{2}$$

$$K = K_d + K_f, \quad T = T_d + T_f. \tag{3}$$

The host country government imposes a tariff (subsidy) on each industry. The domestic price of each good is

$$q_x = (1 + t)p_x , \tag{4}$$

$$q_y = (1 + s)p_y . \tag{5}$$

where q_x (q_y) is the domestic price of X (Y), and p_x (p_y) is the world price of X (Y). The tariff (subsidy) rate is determined endogenously through lobbying by each industry. Each industry hires lobbyists who put political pressure to the government to obtain protection. The lobbying activity utilizes only the following endogenous protection function which determines the size of the tariff as a function of lobbying

$$t = t(L_m - L_a), \quad s = s(L_a - L_m), \tag{6}$$

where L_m (L_a) is a lobbying input by manufactured (agricultural) sector. We assume that the shape of the tariff (subsidy) function, is as follows:

$$\begin{aligned} t(o) &= 0, \quad t' > 0, \quad t'' < 0, \\ s(o) &= 0, \quad s' > 0, \quad s'' < 0. \end{aligned} \tag{7}$$

This implies that for a given rival's lobbying behavior, the marginal product of the lobbying by each industry is positive but decreasing. These equations mean that when the X industry faces an import tariff, the Y industry faces an export tax and vice versa. A representative consumer has a well-behaved utility function U(X, Y). The consumer demand for each good can be written, $X^d(q_x, q_y, I)$ and $Y^d(q_x, q_y, I)$, where I denotes income.

I turn to the foreign country. The transformation curve does not change over periods,

$$Q^*_y = H(Q^*_x, K^* - K_f, T^* - T_f), \tag{8}$$

where $Q^*_y(Q^*_x)$ is the output of the agricultural (manufactured) good and K^* (T^*) is the existing stock of capital (land). The foreign country exports (imports) the manufactured (agricultural) good. It faces the reciprocal demand function (offer curve)

$$M^*_y = \Phi(E^*_x, K_d + K_f, T_d + T_f, L - L_m, \tau), \tag{9}$$

where

M^*_y : foreign import of good Y,

E^*_x : foreign export of good X,

L_m : the amount of the labor devoted to the lobbying,

τ : relative tariff rate, $(1 + t)/(1 + s)$

The preferences of the consumers are summarized as the social utility function, $W(C^*_x, C^*_y)$ which depends on the consumption of both goods.

Since perfect competition prevails in every market, each individual firm has no market power. The foreign firm cannot affect the tariff level through the DFI. To examine the quid pro quo DFI, we assume that the foreign government controls the total amount of the DFI. The government determines the level of DFI to maximize its national welfare. Thus, there are three players in the game we consider: the foreign government, the host-country representative manufacturing firm and the host-country representative agricultural firm.

There are two periods in the model. The timing of the game is as follows:

Period 1. 1. The foreign government chooses DFI which remain fixed.

2. There exists no lobbying and free trade prevails.

Period 2. 3. Both domestic industries lobby and the endogenous tariff rate is determined.

4. Given this tariff rate, trade occurs.

The foreign government moves as the Stackelberg leader, while the two host-country firms move as simultaneous Stackelberg followers. The structure of the model can generate quid pro quo DFI, and it is identical to the one used by Bhagwati(1987). The foreign government does not necessarily choose DFI to maximize its national welfare under free trade (the first period welfare). It could endure a first-period welfare loss for the purpose of obtaining the larger second period welfare.

2.3. The Equilibrium

This section analyzes the equilibrium of the model. I solve for the equilibrium in the usual backward fashion. In the second period, given a level of DFI, and the domestic prices of goods and labor, each domestic firm chooses its labor inputs for production and lobbying simultaneously in order to maximize its myopic (one-period) profit. The profit of the manufacturing firm is

$$\max_{L_x, L_y} \prod_x = [1+t(L_m - L_o)]P_x F(K, L_x) - wL_x - wL_m. \tag{10}$$

where w is the wage rate. I impose the Cournot assumption with respect to the lobbying behavior, that is, each firm decides its lobbying activity, taking the rival's lobbying activity as given. The first order conditions for the above problem are

$$(1 + t)p_x F_L - w = 0, \tag{11}$$

$$t' p_x F - w = 0. \tag{12}$$

where $F_L = \partial F / \partial L_x$.

The second order condition is assumed to be satisfied.

$$M = (1+t) F_{LL} F t'' - (t' F_L)^2 > 0, \tag{13}$$

where F_{LL} is the second order derivative. The economic problem of the agricultural sector is

$$\max_{L_a, L_y} \Pi_a = [1 + s(L_a - L_m)] P_y G(T, L_y) - w L_y - w L_a. \tag{14}$$

I obtain the first-order conditions

$$(1+t) p_y G_L - w = 0. \tag{15}$$

$$s' p_y G - w = 0. \tag{16}$$

The second order condition is

$$A = (1+s) G_{LL} s'' G - (s' G_L)^2 > 0. \tag{17}$$

The equilibrium in the labor market is given by the full employment condition.

$$L_x + L_m + L_m + L_a = L, \tag{18}$$

where L stands for the fixed endowment of labor. Equations (11), (12), (15), (16), and (18) describe the equilibrium of the production sector. These five equations determine the five endogenous variables L_x L_y L_m L_a,

and w. We assume that this system of equations has a unique solution for a given K, T, P_x, P_y, and L. The production level of each good, the endogenous tariff rate, and the domestic prices are determined based on these variables. Finally, by substituting the values of the endogenous variables into the demand equation, I can calculate the demands for both goods, imports and exports.

Given the equilibrium of the host country and the level of DFI, the foreign government chooses outputs of goods and the volume of trade in order to maximize its national welfare, $W(C^*_x, C^*_y)$. It solves the following problem:

$$\begin{aligned} &Max\ W^2(C_x^{*2}, C_y^{*2}) \\ &s.t.\ C_x^{*2} = Q_x^{*2} - E_x^{*2} \\ &C_y^{*2} = Q_y^{*2} + \Phi(E_x^{*2}, K_d + K_f, T_d + T_f, L - L_n, \tau) \end{aligned} \tag{19}$$

where the superscript denotes period 2. The maximum possible welfare level as a function of direct foreign investment in the first period is denoted by $W^2(K_f, T_f)$.

Consider now the first period. Since there is no lobbying, the equilibrium is described by the specific-factor model with direct foreign investment. Given the level of DFI, the equilibrium values of L_x, L_y and w in the home country are defined by

$$p_x F_1(K, L_x) - w = 0, \tag{20}$$

$$P_y G_1(T, L_y) - w = 0, \tag{21}$$

$$L_x + L_y = L. \tag{22}$$

The foreign country's reciprocal demand function in the case of free trade is simplified as

$$M^*_y = \Phi(E^*_x,\ K_d + K_f\ ,\ T_d + T_f\ ,\ L\ ,\ 1\ )$$

$$= \Psi(\ E^*_x,\ K_d + K_f\ ,\ T_d + T_f\ ). \qquad (23)$$

The foreign government has a intertemporal utility function

$$V = \hat{W}^1(C^{*1}_x, C^{*1}_y) + \rho\hat{W}^2(C^{*2}_x,\ C^{*2}_y), \qquad (24)$$

where ρ is the discount factor. The optimization problem is

$$\text{Max}\quad V$$
$$\text{s.t. } C^{*1}_x = Q^{*1}_x - E^*_x,$$
$$C^{*1}_y = Q^{*1}_y + \Psi(\ E^*_x,\ K_d + K_f\ ,\ T_d + T_f\ ). \qquad (25)$$

The foreign government chooses the level of DFI. Given this level, all remaining variables are determined.

2.4. The Basic Comparative Statics

I start with the comparative statics of the second period production equilibrium with respect to DFI and mobility of labor.

(Proposition 1)

(A) The effects of DFI on the manufacturing (importing) sector.

(1-1) The labor input of the manufacturing industry for production and the total labor input of the manufacturing industry increase, if the following condition is satisfied.

$Z = t'F_K - (1+t)F_{LK} \leq 0.$

(1-2) The labor input of the agricultural industry for production decreases.

(1-3) The wage rate goes up.

(1-4) The output of the manufacture (agriculture) industry increases (decreases).

(1-5) The difference of labor input for lobbying activity between two industries expands.

(B) The effects of DFI on the agricultural (exporting) sector.

(1-6)The labor input of the agricultural sector for production and the total labor input of the agricultural industry increases, if the following condition is satisfied.

$N = s'G_L - (1+s)G_{LT} \leq 0.$

(1-7) The labor input of the manufacturing indusstry for production decreases.

(1-8) The output of the agricultural (manufacturing)industry increase (decreases).

(1-9) The wage rate goes up.

(1-10) The difference of labor input for lobbying activity between two industry shrinks.

(C) The effects of immigration of labor.

(1-11) The labor input for production of each industry, the rental rates for capital and land, the wage rate, the difference of labor input for lobbying activity between two industries does not change.
(1-12) The labor input for lobbying of each industry increases equally.

The condition in (1-1) means that the effect of DFI in the manufacturing sector on the marginal value product of the productive labor ($(1 + t)\ p_x\ F_{1k}$) exceeds that on the marginal value product of the lobbying activity ($t'p_xF_k$). In other words, DFI favors the productive labor more than the lobbying labor in the manufacture industry. It is natural that this condition is sufficient for the increase in L_x. This argument applies to the condition in (1-6). The result (1-1) implies that the total labor input of agriculture decreases, since the total labor supply is fixed. The comparative statics' properties in the usual specific factor model does not change in this framework. See Jones(1971). The result (1-10) implies that the tariff rate on the importing sector decreases as the result of DFI in the exporting sector. The reduction in the tariff rate in the second period encourages DFI in the first period, that is, quid pro quo DFI. The result (1-5) means that the endogenous tariff rate on the importing industry and the tax rate on the exporting industry increases when DFI occurs in the importing sector increases. The DFI expands the distortion of the relative price $(1+t)/(1+s)p_x/p_y$. Since the importing industry is more protected as a result of the DFI and foreign export becomes difficult, I need another factor in order to raise the quid pro quo DFI. Both (1-11) and (1-11) imply that the immigration of labor only changes the labor input for lobbying activity. Since both the tariff and tax rates do not change, every variable affecting national welfare, such as production, export, import, and prices, remain constant

after the change in the immigration of labor. An increment of labor is absorbed in the rent-seeking lobbying sector. Although the lobbying sector ($L_m + L_a$) expands, its impacts on t and s are identical.

2.5. Optimal Direct Foreign Investment

I characterize the optimal DFI for the foreign government. In the second period, the government solves the problem (19). The necessary conditions for a maximum are

$$W^2_x/W^2_y = -H^2_x, \tag{26}$$

$$W^2_x/W^2_y = \Phi^2_x. \tag{27}$$

The optimal policy requires that the consumer price (W^2_x/W^2_y) the producer price ($-H^2_x$), and the trade price (Φ^2_x) be the same. The impacts of DFI on the second period's utility are

$$\frac{dW^2}{dK_f} = W^2_y\left[-H^2_k + \Phi^2_t - \Phi^2_l\frac{\partial L_n}{\partial K_f} + \Phi^2_\tau\frac{\partial \tau}{\partial K_f}\right], \tag{28}$$

$$\frac{dW^2}{dT_f} = W^2_y\left[-H^2_l + \Phi^2_t - \Phi^2_l\frac{\partial L_n}{\partial T_f} + \Phi^2_\tau\frac{\partial \tau}{\partial K_f}\right] \tag{29}$$

The optimal conditions for the whole problem are:

$$W^1_x/W^1_y = -H^1_x, \tag{30}$$

$$W^1_x/W^1_y = -\psi_x \tag{31}$$

$$dV/dk_f = dW^1/dK_f + \rho dW^2/dK_f$$

$$= dW^1_y(-H_k+\psi_k) + \rho W^2_y(-H^2_k + \Phi^2_k - \Phi^2_1 \partial L_m/\partial K_f + \Phi^2_\tau \partial \tau/\partial K_f)$$

$$= 0. \tag{32}$$

$$dV/dT_f = dW^1/dT_f + \rho dW^2/dT_f$$

$$= dW^1_y(-H_L+\psi_T) + \rho W^2_y(-H^2_L + \Phi^2_L - \Phi^2_1 \partial L_m/\partial T_f + \Phi^2_\tau \partial \tau/\partial T_f)$$

$$= 0. \tag{33}$$

Two additional terms emerge in the second period effect because of the reallocation of labor ($-\Phi^2_1 \partial L_m/\partial K_f$, $-\Phi^2_1 \partial L_m/\partial T_f$) and the change in the tariff rate.

To examine conditions (32) and (33), we assume that the home country has a utility function , $U(C_x, C_y) = U_0(C_y) + C_x$. This quasi-linear utility function implies that the host country's demand for good Y is independent of income. With $\Phi(\psi)$ denoting the output of good Y - the consumption of good Y in the second (first) period and the results of the comparative statics, I obtain

$$\Psi_k < 0, \ \Psi_T > 0, \ \Phi_k < 0, \ \Phi_T > 0, \ \Phi_L > 0, \ \Phi\tau > 0. \tag{34}$$

Before examining a quid pro quo DFI, I have another route which induces DFI from the foreign government although it has no incentive in the myopic context. This is the effect through a change in the labor

reallocation between the production and the lobbying activity. If DFI increases the amount of labor devoted to the production ($\partial L_n/\partial K_f < 0$, $\partial L_n/\partial T_f < 0$) DFI increases the exports of the foreign country through this productive labor expansion ($- \Phi^2_1 \partial L_n/\partial K_f > 0$, $- \Phi^2_1 \partial L_n/\partial T_f > 0$), and increases the second period utility. This effect differs from the original quid pro quo effect the first period DFI reduces the second period protection. But the economic implication of this "productive labor expansion effect" is the same as the original one. We state:

(Proposition 2)

If the "productive labor expansion" effect ($- \Phi^2_1 \partial L_n/\partial K_f$, $\Phi^2_1 \partial L_n/\partial T_f$) is sufficiently large, the foreign government has a incentive for DFI.

2.6. Quid Pro Quo Direct Foreign Investment

This section examines the possibility of quid pro quo DFI in the importing and exporting sector. Consider DFI in the exporting sector. Since the DFI reduces the tariff rate in the importing sector, it promotes the export of the home country ($\Phi_2 dt/dT_f > 0$). This makes a gain in the second period [See (32)]. Even though the DFI causes a loss in the first period, the home government makes DFI to obtain this gain.

(Proposition 3)

The foreign government has an incentive to engage in quid pro quo DFI in the exporting sector.

The above proposition is novel. Bhagwati et al.(1987) analyze the HOS model. They assume a single capital and can not examine in which sector a quid pro quo DFI appears. Dinopoulos(1989), (1992), and Zhao (1990) examine quid pro quo DFI in the importing sector in the partial equilibrium framework.

The impact of DFI in the importing sector on the first period's utility dW^1/dK_f is negative. When the foreign government is myopic, it has no incentive to invest in the host country. Since more DFI causes more protection ($dt/dK_f > 0$) and higher tariff rates reduce the export of the foreign country ($\Phi_t < 0$), I conclude that the impact of DFI in the importing sector through the lobbying activity is negative. Like Dinopoulos (1992) and Zhao (1991), no quid pro quo DFI occurs.

I seek another political process which causes quid pro quo DFI in the original sense. Bhagwati (1985) states:

"Such "image building" can influence Congress to withstand the protectionist pressures from the import-competing industry."

Following the above statement, I introduce this effect into the tariff function in the importing sector. The function is now reformulated as

$$t = t(L_m - L_a,\ K_f) \tag{35}$$

The tariff/tax rate depends not only on the difference of the labor input for lobbying between industries but also on the level of DFI, itself. I assume

$$t_1 > 0,\ t_{11} < 0,\ t_2 < 0,\ t_{22} > 0,\ t_{12} < 0, \tag{36}$$

where $t_1 = \partial t/\partial(L_m - L_a)$, $t_2 = \partial t/\partial K_f$ and so on.

The higher the level of DFI, the lower the tariff rate, but its marginal effect decreases as DFI increases. The marginal effect of each factor decreases as its rival factor increases.

The effect of DFI on the tariff rate is

$$dt/dK_f = t_1 d(L_m - L_a)/dK_f + t_2. \tag{37}$$

If DFI decreases $L_m - L_a$, the tariff rate decreases as the result of DFI. Simple manipulation leads to

$$\frac{d}{dK_f}(L_m - L_a) = -\frac{1}{det\ D'} \cdot \{-(1+s)p_y G_{LL} + s' p_y G_L\} \times [-(1+t)p_x F_{LL}\{t_{12} p_x F + t_1 p_x F_K\} + t_1 p_x F_L\{t_2 p_x F_L + (1+t)p_x F_{LK}\}] \tag{38}$$

where D' is the coefficient matrix of the reformulated system and det D' < 0. If both $t_{12}p_xF + t_1pF_K$ and $t_2p_xF_L+(1+t)p_xF_{LK}$ are negative, I get $d(L_m - L_a)/ dK_f < 0$. The former inequality means that the impact of DFI on the marginal value of L_m, t_1p_xF, through the political process ($t_{12}p_xF$) exceeds that through the direct productive process ($t_1p_xF_K$), while the latter inequality implies that the same property holds on the impact with respect to the marginal value of L_x. With these inequalities, the endogenous tariff rate decreases as DFI increases. DFI improves the second period welfare by reducing the tariff rate ($\Phi_t dt/dK_f > 0$). The foreign government uses DFI the future benefit even though it generates a first period welfare loss.

I summarize the argument as follows:

(Proposition 4)

Suppose that the tariff function is $t = t(L_m - L_a, K_2)$ satisfying (39). The foreign government obtains an incentive to engage in quid pro quo DFI in the importing sector if the following inequalities hold

(a) $t_{12}p_xF + t_1p_xF_k < 0$.

(b) $t_2p_xF_1 + (1+t)p_xF_{1k} < 0$.

2.7. Concluding Remarks

The present chapter has formulated a specific-factor, two-period, two-country general equilibrium model with an endogenous tariff determined by lobbying activity of each industry. The lobbying activity uses a productive resource, labor. The wage rate is determined by the labor market equilibrium, and is not assumed to be fixed. I have examined three problems: (1) the impacts of DFI in the exporting and importing sector on the second period equilibrium, (2) which DFI reduces the protection encourages quid pro quo DFI, (3) the possibility of new type of quid pro quo DFI.

CHAPTER 3
LEARNING-BY-DOING AND THE PATTERN OF INTRAINDUSTRY TRADE

3.1. Introduction

Traditional static models of intraindustry trade based on monopolistic competition and static scale economies cannot determine the pattern of intraindustry trade (Krugman(1979), Lancaster(1979), Helpman and Krugman(1985). Bhagwati(1982) has proposed a novel explanation of intraindustry trade patterns under the label of "biological" model of trade in similar products. Countries with identical technological capabilities (i.e. Japan and the U.S.) could develop different products in autarky because of differential tastes. Learning-by-doing fixes the comparative advantage of each country within each industry, and when trade starts these countries exchange similar products developed in autarky. The term "biological" captures the feature that technology plays, which is analogous to "genotype" in biology, whereas each product develop in autarky is like the "phenotype" in biology, with differential national tastes corresponding to the environment which shapes the type of similar products a country cab produce.

Feenstra(1982) and Dinopoulos(1988) have developed models of intraindustry trade based on differential national tastes. However, these models do not examine the role of learning-by-doing in determining the initial comparative advantage of each country. The present paper complements the above mentioned studies by developing a simple dynamic general equilibrium model of intraindustry trade based on learning-by-

doing. The model with building blocks for the context Krugman(1987) who examined the role of learning-by-doing in industrial targeting.

In the present model, two types of consumers in each of the two countries are considered. Each type has preferences over a particular set of similar products. The distribution of the two types of consumers differs across the two countries. Current productivity of labor, which is the only factor of production, increases over time because of learning-by-doing considerations.

The dynamic nature of the model allows us to determine the duration of autarky based on transport costs. In the absence of transport costs (or any barriers to trade), the location of production is indeterminate. Transportation costs provide a realistic and natural way to generate an initial period without trade, which is necessary to allow the interaction between national differential tastes and learning-by-doing. This research investigates the effects of domestic income transfers across different types of consumers, tariffs and import quotas on the pattern and volume of trade.

The rest of the chapter is organized as follows: Section 3.2 develops the model. Section 3.3 analyzes the autarkic equilibrium. Section 3.4 examines how the pattern of intraindustry trade evolves over time. Section 3.5 investigates the impact of income transfers, tariffs and import quotas on the pattern and volume of trade. Section 3.6 concludes.

3.2. The Model

There are two types of consumers in the home country and the foreign country. Each type (type 0 and type 1) has the CES utility function:

$$\text{type 0.} \quad u(x_0, x_n) = \left(\sum_{i=1}^{i=n} x_i^{\rho}\right)^{\frac{1}{\rho}}$$

$$\text{type 1.} \quad u(y_1, y_m) = \left(\sum_{i=1}^{i=m} y_i^{\rho},\right)^{\frac{1}{\rho}},$$

where $x_i(y_i)$ is consumption of the i-th product by type 0(1) consumer and $0 < \rho < 1$. Type 0 individual consumes only differentiated product x, while type 1 consumers only differentiated product y. The number of the goods each consumer purchases, n and m, respectively, are fixed.

There is one unit of labor (consumer) in each country. We consider the distribution of consumers as mirror images of each other. That is, the home country has s(1-s) fraction of the type 0(1) consumer, while the foreign country has 1-s(s) fraction of the type 0(1) consumer. We assume that $s \geq 0.5$, which means that the home country has a stronger national demand for the type 0 goods than type 1 goods and the reverse pattern of preference prevails in the foreign country except for s=0.5. Both countries have the same tastes when s=0.5.

The only factor of production is labor. At the initial stage, each country has the same technology exhibiting constant returns to the production of each good.

$$x_i = k(0)l_i,\ y_j = k(0)l_j, \tag{1}$$

where $l_i(l_j)$is labor developed to production of the $x_i(y_j)$and $k(0) > 0$, is the production coefficient at the initial stage.

I assume that there is learning-by-doing in each industry. At time t, the production technology of each industry is given by

$$x_i(t) = k_i(t)l_i(t),\ \ y_j(t) = k_j(t)l_j(t), \tag{2}$$

where $k_i(t)[\ k_j(t)]$ is the production coefficient of goods, $x_i[y_j]$. The coefficient k_i is embodied in the learning-by-doing effect. Each firm can learn from its experience and improve its technology. The accumulated production of each firm represent its experience.

There is no spillover regarding learning effects across firms or countries. I define the learning-by-doing effect as

$$\begin{aligned} k_i(t) &= [\int_{s=0}^{s=t} x_i(s)ds + k_0^{\frac{1}{\varepsilon}}]^{\varepsilon}, \\ k_j(t) &= [\int_{s=0}^{s=t} y_i(s)ds + k^{\frac{1}{\varepsilon}}_0]^{\varepsilon}, \end{aligned} \tag{3}$$

where $0 < \varepsilon < 1$. This learning effect is assumed to occur at the industry level and to work as external economy for each firm. Perfect competition is compatible with this phenomenon.

3.3. Trade at The Initial Equilibrium

First, I derive the initial equilibrium of each country. Since each country has identical production technology and each good appears symmetrically, the initial equilibrium is given by

The home country:

$$p_i = w/k(0),\ x_i = sk(0)/n,\ y_j = (1-s)k(0)/m,$$
$$l_i = s/n,\ l_j = (1-s)/m. \qquad (4)$$

where p_i is the price of the i-th good, w is the wage rate, x_i (y_j)is the output of the i(j)-th good belonging to type 0(1), and l_i(l_j) is the labor employed in the i(j)-th sector of the type 0(1) goods.

The foreign country:

$$p^*_i = w^*/k(0),\ x^*_i = (1-s)k(0)/n,\ y^*_j = sk(0)/m,$$
$$l^*_i = (1-s)/n,\ l^*_j = (1-s)/m. \qquad (5)$$

Reflecting the pattern of taste of each country, the home country produces more quantity of type 0 goods than the type 1 goods, while the foreign country produces more quantity of type 1 goods than the type 0 goods.

I proceed to examine the pattern of trade by assuming "iceberg" type transportation costs: A fraction of g (<1) of any good shipped to the other country actually arrives. A fraction of 1-g of any goods evaporates during transportation. Suppose that the home (foreign) country exports the i(j)-th goods, the following inequalities must hold.

$$p_i/g < p^*_i \quad , \quad p^*_j/g < p_j. \tag{6}$$

Combing these two inequalities and using (5), we have the inequality $g^2 > 1$. This contradicts the assumption $g < 1$. There occurs no trade at the initial stage. This result is natural, since this economy is Ricardian and both countries have the same technology at the initial stage. Note that no trade occurs even if there are no transportation costs.

3.4. The Dynamic Behavior of The Economy

In this section, I investigate the dynamic pattern of trade. Since no-trade occurs at the initial stage, a no trade period lasts. During this period, I can divide all goods into type 0 and type 1, since the initial equilibrium is symmetric. Within each group, prices, outputs, and labor inputs should be identical.
The equilibrium at time t is
Home country:

$$p_0(t)k_0(t) = w(t), \quad p_1(t)k_1(t) = w(t),$$
$$x(t) = sk_0(t)/n \ , \quad y(t) = (1-s)k_1(t)/m \tag{7}$$

where the subscript 0(1) denotes type 0(1).
Foreign country:

$$p^*_0(t)k^*_0(t) = w^*(t), \quad p^*_1(t)k^*_1(t) = w^*(t)$$
$$x^*(t) = (1-s)k^*_0(t)/n \ , \ y^*(t) = sk^*_1(t)/m. \tag{8}$$

Since the home country produces more output of type 0 goods than the foreign country, we have

$$k_0(t) > k^*_0(t),\ x(t) > x^*(t),\ k_1(t) < k^*_1(t)\ ,\ y(t) < y^*(t). \qquad (9)$$

As time moves on, the learning-by-doing effect changes the production coefficients in both countries. The initial difference in outputs between countries causes the change in the production coefficients, which results in the difference in outputs in the following period. The home country develops a comparative advantage in type 0 production, while the foreign country develops a comparative advantage in type 1 goods through this process.

I expect to be a switching point T, the time when dynamic comparative advantage overcomes the barrier of the transportation cost and trade starts. The home country exports type 0 goods and the foreign country exports type 1 goods. If trade starts at time T, both countries can export thus, the following two inequalities must hold:

$$p_0(T)/g < p^*_0(T),\ p^*_1(T)/g < p_1(T). \qquad (10)$$

Using (9), we rewrite (10) as

$$k_1(T)/k_0(T) < g^2 k^*_1(T)/k^*_0(T). \qquad (11)$$

Inequality (11) means that net of transportation costs, the home country has comparative advantage in type 0 goods, while the foreign country has a comparative advantage of type 1 goods. I define the function H(t) to analyze the pattern and the timing of trade.

$$H(t) = k_1(t)/k_0(t) < g^2k^*_1(t)/k^*_0(t).$$

If H(t) takes negative value at some t, trade occurs. At t=0, H(0)=1-g > 0. Thus, trade does not occur at the initial equilibrium. H(t) is continuous in t. This implies that a no trade period prevails in some range of time near time 0.

Since the shape of H(t) is ambiguous, two cases are possible: (1) there is a time t with H(t) = 0. (2)H(t) is positive for all t. Case (2) means that no trade occurs forever. Therefore, we focus on the case (1). There may be multiple time intervals such that H(t)=0. Consider the first time t=T with H(T)=0 and assume the regularity condition dH(t)/dt < 0 at t=T. Take the time t+h, where h is a sufficiently small positive number. From the regulatory condition, H(t+h) is negative, which means the home (foreign) country has comparative advantage in the type 0(1) goods. The home country exports type 0 goods, while the foreign country exports the type 1 goods. We assume that complete specialization occurs. The type 0 goods are produced only in the home country, while the type 1 goods are produced only in the foreign country. Once specialization prevails, the learning -by-doing effects appears in neither type 1 goods of the home country nor the type 0 goods of the foreign country. So the coefficient of these goods do not change. On the other hand, the coefficient of exported goods increases as time passes. H(t) remains negative after the time t+h. This shows that the time T is the switching point from the no trade period to the trading periods. This switching takes place just one time and there is no reversal of the trade pattern.

Proposition 1

There is a unique switching point, T. Before T there is no trade. After T, there is trade based on taste difference across countries.

The difference in tastes in each country generates a difference in technologies. In our Ricardian economy, technological differences determine the trade pattern. Each country exports goods with larger domestic demand. Consider the case of s=0.5. In this case, both countries have the identical tastes. At the initial stage, both countries produce the same amount of all goods. Since both countries have the same production coefficients, trade does not occurs at any time. This is the subtle situation, because even if s deviates from 0.5 by a very small amount, trade can occur eventually.

To describe the trading equilibrium, we normalize the home wage to 1.

$$P_0 k_0 = 1, \tag{12}$$

$$p^*_1 k^*_1 = 1, \tag{13}$$

$$1 = s + (1-s)w^*. \tag{14}$$

Equation (12) is the zero profit condition of the home country's firm and (13) shows the zero profit condition of the foreign firm. Equation (14) is the market clearing condition for type 0 goods. Equations (12), (13) and (14) determine three variables p, p^* and w^*. Equation (14) implies that w = 1, i.e. the same wage rate prevails in both countries. This property comes from the assumption that the distribution of preferences across the two countries are the mirror images of each other.

I examine the effects of the transportation cost and the learning-by-doing parameter on the switching point. Differentiating the equilibrium condition H(T) = 0 with respect to the transportation costs and assuming the regularity condition H'(T) < 0, we obtain

$$dT/dg = 2gk^*_1(T)/H'(T)k^*_0(T) < 0. \tag{15}$$

The inequality (15) means that the length of the no trade period increase as the transportation cost increases.

3.5. The Effects of Government Policies

In this section, I examine two types of government policy, income tax (transfer) and trade policy such as a tariff and a quota. Without loss of generality, we focus on of home-country policies.

First, I analyze the impact of income tax (transfer). We consider the income tax and transfer policy at the initial stage. The government imposes wz income tax on type 0 consumers and gives this tax revenue to type 1 consumers. Since we assume that the labor supply is fixed, income tax is equivalent with the pure transfer program. Once this policy is introduced, the outputs of the both goods are

$$\text{type 0 goods: } (s-z)/n, \quad \text{type 1 goods: } (1-s+z)/m. \tag{16}$$

If the output of the type 1 goods produced at the home country exceeds that of the foreign country, the inequality

$$1 - s + z > s \tag{17}$$

must hold. This inequality implies that $z>2s-1$. This also means that the home country produces less the type 0 goods than the foreign country does.

At the initial stage, trade does not occur. I assume that the government implements this tax-transfer policy for some time interval.

During the no trade period, the home country is developing comparative advantage in type 1 goods over the foreign country. After some time passes, trade occurs but the trade pattern is completely reversed. After trade starts, the government does not need to adopt this policy because the pattern of production is fixed. I have

Proposition 2

The government of the home country can completely reverse the existing pattern of trade by taxing the type 0 consumer by wz (z>2s-1) and transferring this to the type 1 consumer during the no trade period.

This income transfer program is useful to reverse the pattern of trade as long as it is implemented during the no trade period. However, once trade occurs and the home country imports type 1 goods, this policy becomes useless, since the transfer the type 1 consumer receives is spent on imported type 1 goods. This transfer only contributes to the improvement in the technology of the foreign country.

Next, I investigate the impact of trade policy. Consider a tariff imposed on type 1 goods by the home country. This tariff is applied at the same rate, v, to all the imports. For simplicity, the government introduces the tariff at the initial stage. This tariff is irreverent during the no trade period. We assume that the tariff revenue is distributed equally to all consumers. Since this tariff revenue transfer is neutral to the income distribution among consumers, the patter of production is not affected. The manner in which the tariff revenue is distributed is irrelevant during the no trade period.

If trade takes place at time T, the following inequalities must hold.

$$p_0(T)/g < p^*_0(T), \quad (1+v)p^*_1(T)/g < p_1(T). \tag{18}$$

Following the previous argument, I define the function N(t) as

$$N(t) = (1+v)k_1(t)/k_0(t) < g^2k^*_1(t)/k^*_0(t) \qquad (19)$$

The time N(t)=0 gives the switching point from autarky to the trade period. At the initial stage, $N(t) = 1 + v - g^2 > 0$. We also assume the corresponding regularity condition

$$N'(T) < 0 \text{ if } N(T) = 0.$$

Note that during autarky, the outputs of all goods and all production coefficients are not affected by the tariff. The impact on the switching time is given by

$$\frac{dT}{dv} = -\frac{1}{N'(T)}\frac{k_1(T)}{k_0(T)} > 0. \qquad (20)$$

The introduction of a tariff delays the switching point.

Since autarky lasts longer in the tariff-ridden economy than in free trade, the volume of trade is larger in the tariff-ridden economy than in free trade economy at the switching point. After trade occurs, the pattern of trade becomes the same as that of the free trade. The tariff protects the type 1 industry in the sense that it delays the introduction of foreign competition.

I proceed to investigate a quota. The government sets the uniform import quota of type 1 goods at the level of h. During the no trade period, the quota does not affect the pattern of production. The switching point does not depend on the level of the quota, since the pattern of trade is determined by the relative price of the both goods.

The level of quota does not affect this relative price, while the tariff does affect it. This means that the switching point does not change by the introduction of the quota. At the switching point T, the volume of the imports of type 1 goods equals the $\min[y_{t,}, h]$, where y_t is the import under free trade at T. In each case, there is the time which the quota is binding. The foreign production of the type 1 goods increases over time due to the learning-by-doing effect, the imports will reach the restriction at some time even though h is set at any high level.

Assume that $h<y_t$ at the switching point T. The quota is binding. The home country produces the type 1 goods by y_t-h. If the government auctions the quota, it can earn the monopoly rent. We assume that this rent is redistributed equally to the consumers. The home country can produce and reduces the production by h.

Let assume that $h>y_t$ at the switching point T. Since the quota is not binding, the home country imports type 1 goods and does not produce it. As time passes, the imports increase and reach the limit h at some time T_1. After this time the domestic industry can survive and continue to produce. In this case, the domestic production of the type 1 goods is discontinued from T to T_1.

I summarize the arguments as follows;

Proposition 3

The tariff delays the time when the trade takes place, but domestic production of the protected industry vanishes after this time. On the other hand, the quota does not affect the above time but protects domestic production after the introduction of trade.

Notice that the qualitative results do not depend on the assumption that the tariff revenue and the rent from the quota auction are equally redistribution to the consumers. For example, if all the tariff revenue

is given to the type 1 consumers, the revenue goes to the foreign industry. Domestic production of type 1 goods can not be revived in the future. The manner of redistribution changes the level of the outputs but does not affect the pattern of trade.

3.6. Concluding Remarks

The chapter has developed a two-country dynamic Ricardian model of trade in similar products along the lines suggested by Bhagwati(1982). The model was based on differential national tastes, learning-by-doing and transportation costs. We analyzed the role of these three features in determining the pattern of intraindustry trade. A country exports those similar products which correspond to a larger domestic market. An income transfer policy can reverse the initial pattern of trade in similar products. A tariff or an import quota delays the time when trade starts and reduces the volume of trade. The simple structure of the model allows several possible extensions and generalizations.

CHAPTER 4
TRADE LIBERALIZATION IN AN OPEN ECONOMY WITH A UNIONIZED SECTOR

4.1. Introduction

During the last two decades, the world economy has experienced three distinct and parallel structural changes. First, the process of trade liberalization has intensified through multilateral and regional trade agreements (i.e. NAFTA, Europe 1992,and the Uruguay round). Second, there has been an acceleration of technological progress (e.g. see Berman, Bound and Griliches (1994)). And third, there has been a rise in wage income inequality due to a decline in the demand for less skilled workers (i.e. see Richardson (1995) for a survey).

Several economists have voiced their concerns regarding the possible causal relationship between trade liberalization and the decline in the demand for less skilled workers. (e.g. Wood(1995) and Borjas and Ramey (1994) among others). Other economists have focused on the effects of exogenous technological progress on the rise of wage income inequality. (e.g. Richardson(1995), Berman et al. (1994), and Bhagwati(1995) among others). At the core of the debate on where technology or trade are responsible for the decline in the demand for less skilled workers is the Stolper and Samuelson (1941) mechanism that relates factor prices to commodity prices. According to this mechanism, a reduction in the domestic price of the importable commodity reduces the wage of the factor is used intensively in the production of the importable. An implication of this mechanism is that trade liberalization

that causes a decline in the domestic price of import competing industries that use less skilled workers intensively will eventually reduce the relative demand and the wage of these workers.

The present chapter analyzes the validity of the Stolper and Samuelson (1941) mechanism in economies that are characterized by imperfectly competitive product and factor markets. For this purpose, I construct a general equilibrium model of a small open economy with the following features: The export producing sector is perfectly competitive and utilizes two factors of production, skilled and unskilled labor. The import-competing sector consists of a unionized firm that is protected from foreign competition through an import quota. The domestic monopolist utilizes both skilled and unskilled labor under a constant returns to scale technology. However, unlike the labor demand for skilled workers which is assumed to be competitive, we assume that the unskilled workers in the import-competing sector have formed a labor union. The union bargains with the domestic monopolist over the negotiated wage and the employment of unskilled labor. The bargaining process is modeled as an efficient Nash bargaining game that results in simultaneous determination of employment and the wage.

The model is used to analyze the effects of trade liberalization (i.e. an increase in the quota) and immigration on income distribution and domestic prices. I identify conditions on the parameters of the model that establish the robustness of the Stolper-Samuelson mechanism in the presence of sector-specific labor union. I also characterize the sufficient conditions for the existence of a unique equilibrium.

The model combines two standards of literature that have dealt with similar issues. Batra(1972), Melvin and Warne(1973) and Ikeda(1990) have analyzed the general equilibrium behavior of a domestic monopolist assuming perfect competition in factor markets. Brander and Spencer(1988) and Mezzetti and Dinopoulos(1991) have developed partial-equilibrium

models to examine the effects of trade liberalization in unionized labor demand. In addition, Dinopoulos and Lane(1992),(1997) and Lane and Dinopoulos(1995) have constructed general equilibrium models with sector-specific factors (instead of allowing factor mobility among all production factors) to analyze the effects of trade liberalization on state-owned firms that are modeled as labor unions.

The rest of this chapter is organized as follows: I formulate our model in section 4.2. In section 4.3, uniqueness of equilibrium is proven following Batra(1972). The impacts of bargaining parameters are examined in section 4.4. In section 4.5, I investigate the effects of trade liberalization on factor rewards and whether Stolper-Samuelson mechanism works as a result. I also derive the impact of immigration on factor rewards. The final section is devoted to concluding remarks.

4.2. The Model

Consider a small open economy with two sectors. A unionized sector (X) which the wage and employment are determined through Nash bargaining, and a competitive sector (Y). I designate the production function by $X = F(L_x, H_x)$ and $Y = G(L_y, H_y)$ where L_i and H_i denote unskilled labor and skilled labor employed in the i-th sector with i = x or y. The production functions exhibit constant to scale and can be written in the intensive form,

$$x = X/H_x = f(l_x), \tag{1}$$

$$y = Y/H_y = g(l_y), \tag{2}$$

where $l_x(l_y)$ shows the unskilled-skilled labor intensity in the unionized(competitive) sector. I assume that the representative consumer is characterized by a homothetic utility function , which enables us to write the inverse demand function as:

$$p = u(z), \quad u'(z)>0, \tag{3}$$

where $z=Y_c/X_c$, the relative demand, and subscript c denotes consumption. We normalize the price of good y to the unity and there $p = p_x$ is the price of good X. Moreover, for expositional simplicity, the price elasticity of demand for X , denoted by ε, and assumed to be constant and larger than one. If the utility function is C.E.S. type, the demand elasticity satisfies the above assumptions. [Batra (1971),Melvin and Warne (1973), Konishi, Okuno- Fujiwara, and Suzumura (1990) adopt this assumption.]

I next describe the bargaining process and suppose that only the unskilled labor in sector x can establish a labor union and negotiate with the management about level of their employment(L_x) and wage(r_x). Following Mezzetti and Dinopoulos (1991), I assume that output x is produced by a domestic monopolist. Skilled labor and unskilled labor working in the competitive sector can not form unions and are forced to accept the prevailing competitive wages, w and r_y. The behavior of the labor union is modeled through a utility function that depends on employment and the excess wage($r_x - r_y$),

$$U = (r_x - r_y)^{\theta} L^{\gamma}_x \quad . \tag{4}$$

$\gamma(\theta)$ represents the elasticity of U with respect to excess wage(employment). Following the literature, we assume that the union is employment-oriented, that is, $\gamma > \theta$.

The management of the firm is interested in maximizing its profit, Π_x

$$\Pi_x = pX - r_x L_x - wH_x. \tag{5}$$

Both parties engage in efficient Nash bargaining. The threat point is a pair of $-wL_x$ and 0. This pair is obtained under the assumption that the union strikes (that is, $x = 0$) if there is disagreement during the bargaining process. The generalized Nash bargaining product, G thus is constructed as

$$W = (pX - r_x L_x)^{1-\alpha} U^{\alpha}, \tag{6}$$

where parameter α is the bargaining power of the union and $0 \leq \alpha \leq 1$.

I assume that under free trade, this economy imports the good of the unionized sector and exports the good of the competitive sector. The government imposes an import quota Q as trade restriction measure. Domestic consumption of the two goods is $X_c = F(L_x, H_x) + Q$, and $Y_c = G(L_y, H_y) - Q$. I assume that the consumption of the goods Y is positive under the quota, that is, $G - Q > 0$.

4.3. Uniqueness of Equilibrium

In this section, I focus our attention to issues related to the uniqueness of momentary equilibrium relative to a set of bargaining parameters and the level of quota. Uniqueness of equilibrium is a precondition for the following comparative statics analysis.

The competitive firm hires unskilled and skilled labor to maximize its profit, given the output price(normalized to one) and the factor prices. The optimization conditions for the firm are

$$r_y = g'(l_y) \tag{7}$$

$$w = g(l_y) - l_y g'(l_y). \tag{8}$$

The above conditions give the relation between l_y and the relative factor price in the competitive sector $\omega_y = r_y/w$, as $l_y = l_y(\omega_y)$. Differentiating l_y with respect to ω_y, we have

$$l'_y = \partial l_y / \partial \omega_y = (g - l_y g')/gg'' \quad <0 . \tag{9}$$

Unskilled labor employment and the wage in the unionized sector are determined through a efficient Nash bargaining process. The solution to this bargaining problem is obtained by maximizing the generalized Nash product with respect to the negotiated wage and employment. The two first order conditions of this problem are;

Contract curve.

$$\omega_x = \frac{\gamma}{\gamma-\theta}\omega_y - \frac{\theta}{\gamma-\theta} \times \frac{f'}{f-l_x f'} \quad . \tag{10}$$

Nash bargaining curve

$$\omega_x = [\lambda \frac{f\varepsilon}{l_x f'(\varepsilon-1)} + (1-\lambda)] \frac{f'}{f-l_x f'} \quad . \tag{11}$$

where ω_x is the relative factor price in the unionized sector, r_x/w and $\lambda = \gamma\alpha/(1-\alpha+\alpha\gamma)$ is a parameter. Combing the Contract curve and Nash bargaining curve, I obtain the basic relation between ω_y and l_x.

$$\omega_y = \frac{f'}{f-l_x f'} \times B \, , \tag{12}$$

where

$$B = [\beta\varepsilon f/(\varepsilon - 1)l_x f'] + 1 - \beta \geq 1, \tag{13}$$

and

$$\beta = \alpha(\gamma - \theta)/(1 - \alpha + \alpha\gamma) \, . \tag{14}$$

Since $\varepsilon > 1$ and $f > l_x f'$, B is larger than one. Comparing the Nash bargaining curve (11) and (12) and $\lambda > \beta$, I find that the unionized unskilled workers earn a higher wage, r_x, than do the unskilled workers in the competitive sector. The skilled labor in the unionized sector is employed to maximize profits. The first order conditions for profit maximization is

$$w = p(1 - 1/\varepsilon)(f - l_x f'). \tag{15}$$

I turn to the factor market equilibrium to derive a relation between k_x and ω_y. The supply of the both factors, L and H, are fixed. The full employment conditions are described as:

$$h_x + h_y = 1, \tag{16}$$

$$h_x l_x + h_y l_y = l, \tag{17}$$

where $h_x(h_y) = H_x(H_y)/H$ and $l = L/H$ is the unskilled:skilled labor ratio of the whole economy. Solving the full employment conditions (16), (17) with respect to h_x , h_y and inserting these two variables into the definition of relative demand , we get

$$z = \frac{g(l_x - l) - (l_x - l_y)q}{f(l - l_y) + (l_x - l_y)q} , \tag{18}$$

where $q = Q/H$ and $gh_y - q > 0$ must hold . Equations (9), (12) and (18) determine z as a function of ω_y, given parameters H , Q and l. It is useful for intuitive purpose to investigate this functional relation. From (12), l_x can be written as $l_x = l_x(\omega_y)$. Differentiating (12), we have

$$l'_x = \partial l_x / \partial \omega_y = M(f - l_x f')/ff'' < 0 , \tag{19}$$

where

$$M = \frac{1}{1 - \beta + \beta E - \beta E \times (f - l_x f')/l_x^2 ff''}. \tag{20}$$

and

$$E = \frac{\varepsilon}{\varepsilon - 1} > 1, \tag{21}$$

Note that $0 < M < 1$ since $E > 1$. The unskilled labor intensity of the unionized sector decreases as the relative wage in the competitive sector goes up. Note that (19) relates l_x and the relative wage prevailing in the competitive sector, not in the unionized sector. In our model, the relative wages differ across the sectors because of the bargaining in the unionized sector. Taking into account of (19), differentiation of (18) with respect to l_y leads to

$$dz/d\omega_y = N_1(1-l_y)\,dl_x/d\omega_y + N_2(l_x-1)\,dl_y/d\omega_y, \tag{22}$$

where

$$N_1 = \frac{g(f - l_x f' + kf') + q(g - f + f'[l_x - l_y])}{[f(l-l_y) + (l_x - l_y)q]^2}. \tag{23}$$

and

$$N_2 = \frac{f(g + g'[l-l_y]) + q(g'[l_x - l_y] + g - f)}{(f[l-l_y] + (l_x - l_y)q)^2}. \tag{24}$$

After some algebraic manipulation, I find that N_1 and N_2 take positive values.

(Lemma 1)

If $l_y > (<)\ l_x$, then, $z'(\omega_y) > (<)\ 0$.

Following Batra(1972), Melvin and Warne(1973), I define the consumption price p_c through the utility maximizing behavior of the representative consumer.

$$p_c = u[z(\omega_y)]. \tag{25}$$

Differentiating totally the consumption price function, I get

$$p_c' = \frac{dp_c}{d\omega_y} = u'(z)z'(\omega_y). \tag{26}$$

I can obtain

(Lemma 2)

Suppose that $l_y > (<) \; l_x$. Then, $p_c' > (<) \; 0$.

The consumption price function is upward(downward)sloping with respect to the relative wage in the competitive sector, if the competitive(unionized) sector is unskilled labor intensive.

I also define the production price p_p by the optimization behavior of each firm, (8) and (13).

$$p_p = \frac{E(g - l_y g')}{(f - l_x f')} \tag{27}$$

Noting that $k_x = k_x(\omega_y)$ and E takes a constant value, we have

$$p_p' = \frac{dp_p}{d\omega_y} = D[B(M_x - l_y) + S(1 - \rho_x)], \tag{28}$$

where

$$D = E \times \frac{(g - l_y g f')}{(B + l_x \omega_y)(1 + l_y \omega_y)(f - l_x f g)} > 0. \tag{29}$$

$$S = M l_x l_y \omega_y E \beta \times \frac{(f - l_x f')}{l_x f'} > 0. \tag{30}$$

$$\rho_x = -\frac{f'(f - l_x f')}{l_x f f''} > 0. \tag{31}$$

ρ_x is the elasticity of substitution between skilled and unskilled labor in the unionized sector. If the production function is the Cobb-Douglas type, this elasticity takes the value one. I can prove

(Lemma 3)

(3-1) Suppose that $l_y > l_x$ and $\rho_x \geq 1$.

Then, $dp_p/d\omega_y$ is negative.

(3-2) Suppose that $l_y < l_x$ and $\rho_x \leq 1$.

and if $Ml_x > l_y$. Then, $dp_p/d\omega_y$ is positive.

The assumption that $Ml_x > l_y$ implies that the ranking of value intensity is the same as the physical one despite the wage differential that is induced by unionization. The production price function is downward(upward) sloping with respect to the relative factor price in the competitive sector, if the competitive (unionized) sector is unskilled labor intensive.

Finally, I will establish the relative factor prices of unionized labor in the competitive sector is negatively related to the

factor intensity in the whole economy. Consider equation (18) which includes not only the factor intensity, l, but also the total quantity of skilled labor, H. To find the relation between ω_y and l, we have to investigate two cases: (1) L is fixed and H changes, (2) L changes and H is fixed. I examine the first case.

Differentiating (18) with respect to l, given the fixed ω_y, we have

$$z^1 = \frac{\partial \bar{x}}{\partial} = \frac{[qgh_x + f(g - l_y q/l)](l_y - l_x)}{[f(l - l_y) + q(l_x - l_y)]^2} . \qquad (32)$$

We can show that the sign of z^1 is the same as that of $l_y - l_x$. The relative demand function and the consumption price function shift downward (upward) if $l_x > (<) \; l_y$. The production price function does not change since it is independent of the total factor supply. Considering these observations, we get

(Lemma 4)

$d\omega_y/dl < 0$ and $dp/dl <(>) \; 0$,if $l_x > (<) \; l_y$.

I prove the same result for the second case. This lemma means that the relative unskilled wage in the competitive sector declines if the relative supply of unskilled labor increases, which seems to be plausible. Batra(1972) proves the lemma in the closed economy with C.E.S. utility function. Ikeda(1990) extends the Batra's result to a tax distorted economy. Homma(1977) examines this relation in the economies with homothetic utility function .

Lemma 4 implies that there exists a monotonic functional relation between l and ω_y , which enables us to assert that our model has a

unique equilibrium. Combing Lemmas 1,2,3, and 4, I realize that the intersection of the consumption price function and the production one gives the unique equilibrium relative factor price in the competitive sector. I am now in a position to state the uniqueness property.

(Proposition 1)
There is a unique equilibrium under the following two cases.
(s1) The competitive sector is unskilled labor intensive.
(s2) The unionized sector is unskilled labor intensive and $Ml_x > l_y$ where M is given by (20).

Proposition 1 identifies two restrictions that are fairy general and establish the uniqueness of equilibrium despite of the presence of sector-specific labor union. All remaining variables are also uniquely determined based on the relative factor price in the competitive sector.

4.4. The Effects of The Bargaining Parameters

In this section, I investigate the effects of the bargaining parameters on the relative wages of the both sectors. The bargaining parameters only appears in (12) through parameter β. I easily prove that β increases(decreases) if α, γ (0)increases . The unskilled labor intensity of the unionized sector is a function of the relative wage in the competitive sector and the bargaining parameters: $l_x = l_x(\omega_y : \beta)$. Keeping the relative wage constant and differentiating (12) with respect to l_x and β, we obtain

$$\frac{dl_x}{d\beta} = -\frac{l_x'}{l_x} = l_x^{\beta} > 0. \tag{33}$$

The l_x function shifts upwards as β increases. The relative demand equation (18) is a function β . Differentiating this with respect to l_x and β, we get

$$z^{\beta} = dz/d\beta = N_i(1-l_y)dl_x/d\beta. \tag{34}$$

From (34) I have

(Lemma 5)

Suppose that $l_x >(<) l_y$. Then, $z^{\beta} >(<) 0$.

If the unionized (competitive) sector is unskilled labor intensive, the relative demand goes up (down). Next, I examine the change in the consumption price function. The change is given by

$$p_c^{\beta} = \frac{\partial p}{\partial \beta} = u'(z)z^{\beta}. \tag{35}$$

We have that $p_c^{\beta} >(<) 0$, if $l_x >(<) l_y$. The consumption price function shifts upwards(downwards) if the unionized(competitive) sector is unskilled labor intensive.

Differentiating the production price function (27) , I derive

$$p_p^{\beta} = \frac{\partial p_p}{\partial \beta} = \frac{El_x^{\beta}(g - l_y g')l_x f''}{(f - l_x f')^2} < 0. \tag{36}$$

I show that the production price function moves downwards as β increases. Then, I prove

(Proposition 2)

Suppose that the unionized sector is unskilled labor intensive. Then, the relative wage in the competitive sector increases if the bargaining power of the labor union, α, the preference for the employment, γ, increase and the preference for the excess wage, θ decreases.

If the competitive sector is unskilled labor intensive, the change in relative wage is ambiguous.

I turn to examine the effects on the relative wage of the unionized sector. The Nash bargaining curve (11) gives the relation between the relative wage of the unionized sector and the bargaining parameters. I get,

$$\frac{d\omega_x}{d\beta} = F\frac{d\omega_y}{d\beta}, \tag{37}$$

where

$$F = \frac{1-\lambda+\lambda E-\lambda E(f-l_x f')^2/l_x^2 ff''}{1-\beta+\beta E-\beta E(f-l_x f')^2/l^2{}_x ff''}. \tag{38}$$

Since λ is larger than β, F is greater than one. The direction of change in the relative wage of the unionized sector is identical with that in the competitive sector. Using (35), I have the impact on the relative wage gap across sectors, $\omega_x - \omega_y$,

$$\frac{d}{d\beta}(\omega_x - \omega_y) = (F-1)\frac{d\omega_y}{d\beta} \quad . \tag{39}$$

Since F-1 is positive , the wage gap changes the same as the relative wage in the competitive sector. I summarize these as follows:

(Proposition 3)

Suppose that the unionized sector is unskilled labor intensive.
(3-1) The relative wage of the unionized sector increases if the bargaining power of labor union,α, the preference for employment,γ, increase and the preference for wage,θ, decreases.
(3-2) The relative wage gap between two sectors expands if the bargaining power of labor union,α, the preference for employment,γ, increase and the preference for excess wage,θ decreases.

4.5. The Effects of Trade Liberalization and Immigration

In this section, I investigate impacts of measures of trade liberalization on income distribution among three factors. We also examine the effects when foreign unskilled or skilled labor immigrate to the economy.

In the present model, trade liberalization is captured by an expansion of the existing import quota. Since factor intensity of each sector does not directly depend on the quota, the relative demand z can

be as $z = z(\omega_y:Q)$. For given ω_y, I find that relaxation of the quota decreases the relative demand,

$$z^Q = \frac{\partial z}{\partial Q} = \frac{(l_y - l_x)[f(1-l_y)+g(l_x-l)]}{H[f(1-l_y)-(l_x-l_y)H/Q]^2} < 0. \tag{40}$$

The consumption price function (25) is

$$p_c = p_c[u(z(\omega_y:Q))]. \tag{41}$$

The move of this function resulting from quota relaxation is given by

$$p_c^Q = \frac{\partial p_c}{\partial Q} = u'(z)z^Q. \tag{42}$$

The consumption price function shifts downward if the government relaxes the import quota. The production price is determined only by the optimization behavior of each firm , the labor union, and is independent of the quota level. Therefore, the production price function does not change. We establish

(Lemma 7)

Suppose that the unionized(competitive) sector is unskilled labor intensive. The quota relaxation decreases(increases) the relative wage of unskilled workers in the competitive sector. The price of good X declines as a result of quota expansion.

Considering (35) and (37), I have the impacts on the relative wage of unionized sector and the wage gap moves the same as the relative

wage in the competitive sector. Differentiating (7) and (8) with respect to the quota, we get

$$\frac{dr_y}{dQ} = g'' l_y' \frac{d\omega_y}{dQ}, \tag{43}$$

$$\frac{dw}{dQ} = -l_y g'' l_y' \frac{d\omega_y}{dQ}. \tag{44}$$

Consider the case where the unionized sector is unskilled labor intensive and the government relaxes its quota. The price of the good X declines and the relative wage of the unskilled labor in the competitive sector increases. (43) and (44) state that the wage of the skilled labor which is not employed intensively in the unionized sector goes up, while the unskilled labor wage in the competitive sector which is used intensively in the sector declines. This relation between the output price change and the factor price change implies that the traditional Stolper-Samuelson theorem holds in our model despite of unionization. If the competitive sector is unskilled labor intensive, this theorem also holds as for these factor prices.

I turn to examine the change of the wage of unionized labor. The wage is determined through efficient Nash bargaining

$$r_x = p[\lambda f / l_x + (1-\lambda) f' / E]. \tag{45}$$

The impact of the quota is given by

$$\frac{dr_x}{dQ} = \frac{dp}{dQ}[\lambda f + (1-\lambda) f' / E] + p[\lambda \frac{(f t_x - f)}{l_x^2} + (1-\lambda) f'' / E] l_x' \frac{d\omega_x}{dQ}. \tag{46}$$

The first term of RHS of (46) is negative. The relative wage of the competitive sector decreases if $l_x > l_y$. The second term is negative since the brace in the second term and l'_x are negative. The increase in the price of X raises the wage of unionized labor which is intensively hired in the unionized sector. The Stolper-Samuelson relation holds. We point out that an interesting case may occur. Suppose that $l_x < l_y$. In this case, the output price of X decreases while the relative wage in the unionized sector increases. The two terms of RHS of (46) take opposite signs. I can not derive determinate conclusion. This implies that the Stolper-Samuelson relation may not hold if the effect through relative wage change(the second term) is dominated by the price change effect(the first term). I summarize these observations

(Proposition 4)

(4-1) Stolper-Samuelson theorem holds with respect to the wages of the skilled labor and the unskilled labor in the competitive sector.
(4-2) Stolper-Samuelson theorem holds with respect to the wage in the unionized labor if the unionized sector is unskilled labor intensive.

I turn to investigate the effects of immigration on the income distribution among three factor prices. Consider that foreign unskilled labor immigrate to the economy. This immigration increases the total amount of domestic unskilled labor, L and the unskilled:skilled labor ratio of the whole economy, l. From Lemma 4, I can show that this immigration decreases(increases) the price of good X if the unionized sector(competitive) sector is unskilled labor intensive and decreases the relative wage of unskilled labor in the competitive sector independent of the factor intensity among two sectors.

The impacts on the skilled labor's wage and the unskilled labor's wage employed in the competitive sector are given

$$\frac{dr_y}{dl} = g''l_y' \frac{d\omega_y}{dl} < 0. \tag{47}$$

$$\frac{dw}{dl} = -l_y g''l_y' \frac{d\omega_y}{dl} > 0. \tag{48}$$

The unskilled labor's wage in the competitive sector decreases, while the skilled labor's wage increases. This results does not depend the intensity ranking of the two sectors. The both wages are determined by marginal productivity of factors. Since the unskilled labor supply rises in the economy, the skilled labor becomes less abundant while the unskilled labor does abundant. These change in the two factor price seem to be plausible.

The change in the unskilled labor's wage working in the unionized sector is

$$\frac{dr_x}{dl} = \frac{dp}{dl}[\lambda f + (1-\lambda)f'] + p[\lambda \frac{(fl_x - f')}{l_x^2} + (1-\lambda)f'']l_x' \frac{d\omega_x}{dl} \tag{49}$$

If the unionized sector is unskilled labor intensive, both the output price and the relative wage in the competitive sector go down.
Then, the wage of unskilled labor in the unionized sector decreases. However, if the competitive sector is unskilled labor intensive, the output price increases and the relative wage decreases. The total change in the wage in the unionized sector depends on the magnitudes of two effects. If the effect of output price change dominates that of the relative wage change, the unskilled wage in the unionized sector increases. The unionized unskilled labor with monopoly power can earn

higher wage than the competitive wage, reflecting its marginal productivity. The counterintuitive result comes from this bargaining power. I summarize the observations

(Proposition 5)

(5-1) Immigration of unskilled labor increases the wage of skilled labor and decreases the wage of unskilled labor in the competitive sector.
(5-2) Immigration of unskilled labor decreases the wage of unskilled labor in the unionized sector if the unionized sector is unskilled labor intensive.

If the skilled labor immigrates to the economy, the unskilled:skilled labor ratio in the whole economy declines. The effects of unskilled labor immigration are immediately derived from proposition 5.

4.6. Concluding Remarks

I have formulated a two-by-two open general equilibrium model with bargaining between unskilled labor and the management of firm. The two parties negotiate over the wage and employment. The unionized firm has monopoly power in the product market. The other factor prices,(the wage of unskilled labor working in the competitive sector and that of skilled labor,) are determined by perfect competition. The government has imposed an import quota on the unionized sector.

First, I have examined uniqueness of the equilibrium. In our bargaining model, the physical factor ranking between two sectors does not necessarily coincide with the nominal one, because the sector-specific bargaining generates a discrepancy between unskilled labor's

wages across sectors. I have established uniqueness of equilibrium under the condition that the order of the above two rankings is same. Second, I have investigated the impact of the bargaining parameters on the relative factor prices of unionized and competitive sector. If the unionized sector is unskilled labor intensive, the relative wages of both sectors increase as the union becomes more employment-oriented and its bargaining power rises. Third, I have examined the effects of trade liberalization(quota expansion). I have shown that the Stolper-Samuelson type relation holds as a result of the trade liberalization. Finally, I have derived the effects of immigration. Immigration of unskilled labor favors the skilled labor's wage, while it reduces the unskilled labor's wage in the competitive sector. If the unionized sector is unskilled labor intensive, this immigration decreases the wage of the unionized workers.

CHAPTER 5
CONCLUSIONS

The model in the chapter 2 shows that the level of DFI is substitutive(complementary) to the lobbying activity and protection when DFI occurs in the exporting(importing) sector. The DFI in the exporting sector reduces the level of protection, which encourages the foreign government to engage quid pro quo DFI. On the other hand, the DFI in the importing sector leads to a higher tariff rate. However, if DFI increases the host-country government resistance to lobbying and this effect overcomes the effect of lobbying activity, the tariff rate is reduced by DFI and there is scope for quid pro quo DFI. I show another channel by which DFI influences protection: the amount of labor devoted to productive activities may increase as the result of DFI. The foreign country exports more and obtains a higher level of welfare. The foreign government chooses DFI taking this "productive labor expansion effect" into account. This effect emerges in the general equilibrium framework of the model in which the tariff is determined through resource-using lobbying activities.

Chapter 3 establishes the existence of unique switching point, T. Before T there is no trade. After T, trade occurs based on taste difference across countries. The government of the home country can completely reverse the existing pattern of trade by taxing the type 0 consumer and transferring this to the type 1 consumer during the no trade period. The tariff delays the time when the trade takes place, but domestic production of the protected industry vanishes after this time.

On the other hand, the quota does not affect the above time but protects domestic production after the introduction of trade.

In chapter 4, I prove uniqueness of the equilibrium of the model under the conditions that the physical factor ranking between two sectors coincides with the nominal one and the magnitude of the elasticity of substitution between skilled and unskilled labor in the unionized sector. Next, I investigate the effects of trade liberalization(quota expansion). The Stolper-Samuelson type relation holds as a result of the trade liberalization. Finally, I derive the effects of immigration. Immigration of unskilled labor favors the skilled labor's wage, while it reduces the unskilled labor's wage in the competitive sector. If the unionized sector is unskilled labor intensive, this immigration decreases the wage of the unionized workers.

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BIOGRAPHICAL SKETCH

Makoto Okamura was born in 1956 in Japan. After studying at Keio University, he obtained a Master of Arts in economics at Osaka University in 1982. He entered the PH.D program in economics at University of Florida in 1990.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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